FLAGSTAFF
ENGINEERING

8", 5 1/4" and 3 1/2" Diskette System Installation Guide

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INTRODUCTION

DISKETTE CONNECTION is a hardware and software system that provides an easy method of interfacing many different diskette drives to an IBM PC/XT/AT or compatible computer.

The FLAGSTAFF ENGINEERING 8", 5 1/4" and 3 1/2" diskette system includes a diskette controller card that supports up to four (4) external disk drives. The external drives may be 8", 5 1/4" 96 TPI quad density, 5 1/4" 96 TPI high density (PC/AT compatible), 5 1/4" 48 TPI or 3 1/2" drives.

The controller card is installed inside the computer in any empty expansion slot, and is accessed through a software device driver that must be installed into the DOS operating system. The device driver provides low level I/O support to the card through DOS interrupt 13H. A secondary device driver is included with the system to support the external drives as DOS devices with DOS assigned ID letters.

MODULE OPTIONS

Systems may be ordered with optional modules:

HARD SECTOR OPTION -

Controller card with optional support circuitry for reading hard sector diskettes.

8" DISKETTE DRIVES -

Single or dual drive units in external enclosure. Power supply is included. Available as 110 or 120 volt. Drives interface to controller card through 37 pin ribbon cable.

5 1/4" DISKETTE DRIVES -

Single or dual drive units in external enclosure. Power supply is included. Available as 110 or 120 volt. Drives may consist of the following:

48 TPI 360k drive
96 TPI 720k drive
96 TPI 1.2 Meg. high density drive

3 1/2" DISKETTE DRIVES -

Single or dual drive units in external enclosure. Power supply is included. Available as 110 or 120 volt. Compatible with 3 1/2" single or double sided diskettes.

ABOUT THIS MANUAL

This manual has been designed to accommodate novice as well as expert users. The contents of this manual are labeled by sections and page numbers located at the bottom of every page. As shown from the table of contents, these numbers indicate where you are within any given part of this manual. 1-1, for example, would indicate you are located at the first page of the first section of this manual.

Each numbered section is also cross referenced by page numbers and names of sections in the manual. Please note the bottom of this page. This section of the manual, for example, is named "Introduction," section 1, page 2. Users may move freely through this manual by following page numbers or section name and numbers.

Illustrations, diagrams and schematics have been applied throughout this manual to assist users in better understanding operating processes and procedures.

Should a user find any particular series, set of instructions, processes or aspect of this manual unclear or confusing, please call FLAGSTAFF ENGINEERING's Customer/Technical Support at (602)779-3341 to help clarify and/or assist in successful operations. This service is provided free of charge to registered owners of this system for 90 days from the date of purchase.

SYSTEM DESCRIPTION

When you unpack the DISKETTE CONNECTION system from the shipping carton, you will find the following items:

1. A diskette controller card for your particular application. This card has a 37 conductor "D" connector at one end used to interface all external drives to this card.

2. 8", 5 1/4", or 3 1/2" diskette drive cabinet containing either one or two diskette drives. This unit will either contain only the diskette drive(s) or be furnished in an enclosure with its own power supply and power cord. There is an edge connector at the back of each diskette drive. This connector will be used to interface the drive(s) to your computer. 8" drives have a 50 pin conductor connector, while 5 1/4" and 3 1/2" drives have 34 conductor connectors.

3. A 37 conductor ribbon cable. The cable has a 37 pin "D" connector at one end and a 50 pin conductor or 34 conductor edge connector on the opposite end, depending upon the system configuration you have ordered. Dual drive systems are supplied with two (2) connectors at the drive end of the cable. This cable is used to connect the diskette drive(s) to the diskette controller card installed inside of your computer.

The colored stripe at one edge of the cable indicates pin 50 or pin 34 of the edge connectors, and pin 1 on the "D" connector.

4. Power connection cable for 5 1/4" and 3 1/2" disk drives supplied without external power supply. One end of the cable has a "Y" connector that fits between the existing internal 5 1/4" disk drive(s) and the IBM power connector.

5. A 5 1/4" distribution diskette labeled 'DISKETTE CONNECTION UTILITY/8.' This distribution diskette contains essential device drivers required for system operation, and also includes our excellent diagnostic and utility programs. These programs will be used to confirm proper installation of the system, and furnish utility routines for use with diskettes used in external diskette drives.

The software on this diskette must be used with IBM PC-DOS versions 2.0 or later.

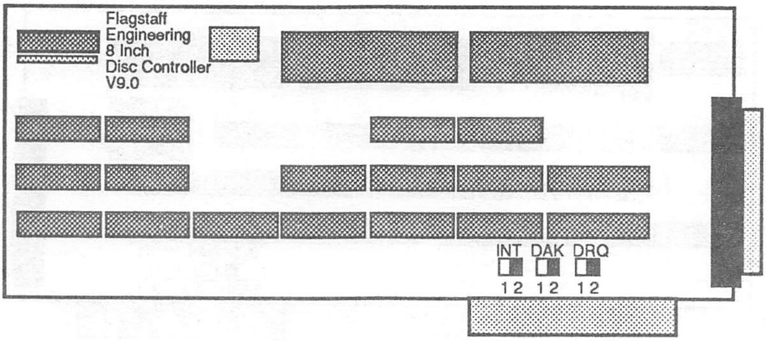
Complete information on the software included on this diskette is contained in the Utility/8 Software Documentation Manual provided to you with this system.

This distribution diskette is an important addition to your software library. *Before you do anything else with your computer*, load the DOS DISKCOPY UTILITY program from IBM and **MAKE A BACKUP COPY OF THE 5 1/4" DISTRIBUTION DISKETTE SUPPLIED WITH YOUR FLAGSTAFF ENGINEERING SYSTEM!**

After you have finished making a backup copy, *store the original diskette in a safe, secure place*.

V9.0 DISKETTE CONTROLLER

Your version 9.0 disk controller card, in the standard default configuration for DMA Channel 2, IRQ 6 operations, should look like this *(not to scale)*:



INSTALLATION FIGURE 1: V9.0 Card (soft sector)

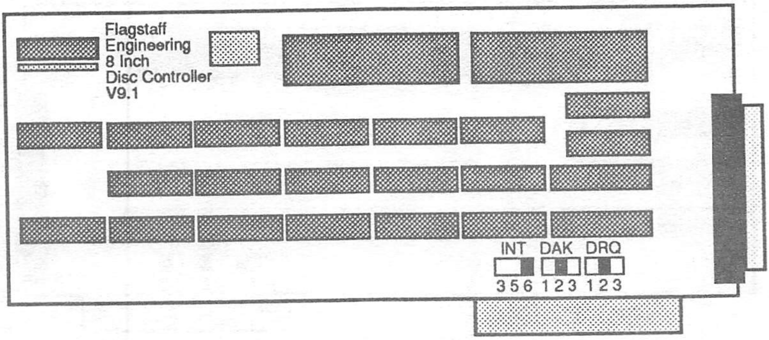
The DMA Channel Jumpers on the V9.0 controller card are connected thus:

INT 1 = IRQ Interupt Request 3
INT 2 = IRQ Interupt Request 6
DAK 1 = DMA Acknowledge Channel 1
DAK 2 = DMA Acknowledge Channel 2
DRQ 1 = DMA Request Channel 1
DRQ 2 = DMA Request Channel 2

NOTE: This is a multitasking controller which will operate 3 1/2", 5 1/4" and 8" disk drives.

V9.1 DISKETTE CONTROLLER

Your version 9.1 disk controller card, in the standard default configuration for DMA Channel 2, IRQ 6 operations, should look like this *(not to scale)*:



INSTALLATION FIGURE 2: V9.1 Card (w/hard sector option)

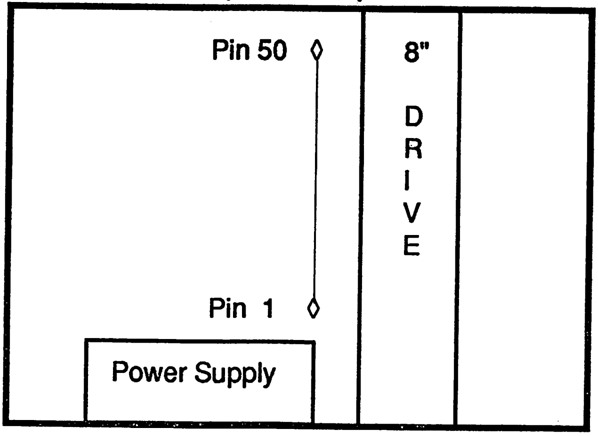
The DMA Channel Jumpers are connected thus:

INT 3 = IRQ Interupt Request 3
INT 5 = IRQ Interupt Request 5
INT 6 = IRQ Interupt Request 6
DAK 1 = DMA Acknowledge Channel 1
DAK 2 = DMA Acknowledge Channel 2
DAK 3 = DMA Acknowledge Channel 3
DRQ 1 = DMA Request Channel 1
DRQ 2 = DMA Request Channel 2
DRQ 3 = DMA Request Channel 3

NOTE: This is a multitasking controller which will operate 3 1/2", 5 1/4" and 8" disk drives.

FLAGSTAFF 8" DISKETTE DRIVE

(Back side)



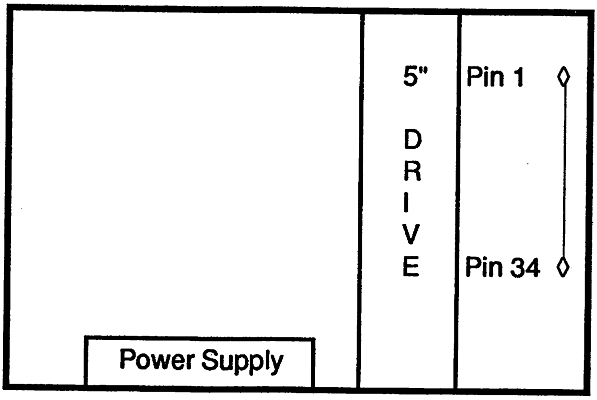
INSTALLATION FIGURE 3: 8" Diskette Drive Connections

Connect card S1 to drive P1

ALWAYS CONNECT THE RIBBON CABLE SO THAT THE COLORED STRIPE ON THE SIDE OF THE CABLE GOES TO **PIN 50** OF THE DRIVE CONNECTOR.

FLAGSTAFF 5 1/4" DISKETTE DRIVE

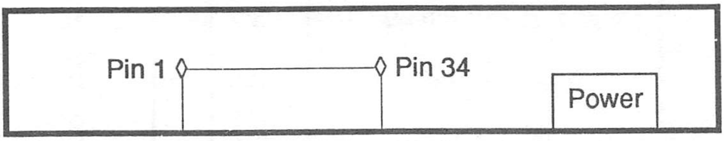
(with built in power supply)



INSTALLATION FIGURE 4.1: 5 1/4" Diskette Drive Connections

Connect card P2 to drive P1

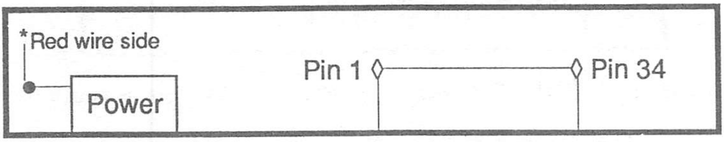
FLAGSTAFF 5 1/4" DISKETTE DRIVE
(without built in power supply)



INSTALLATION FIGURE 4.2: 5 1/4" Diskette Drive Connections

Connect card S1 to drive P1

FLAGSTAFF 3 1/2" DISKETTE DRIVE
(without built in power supply)

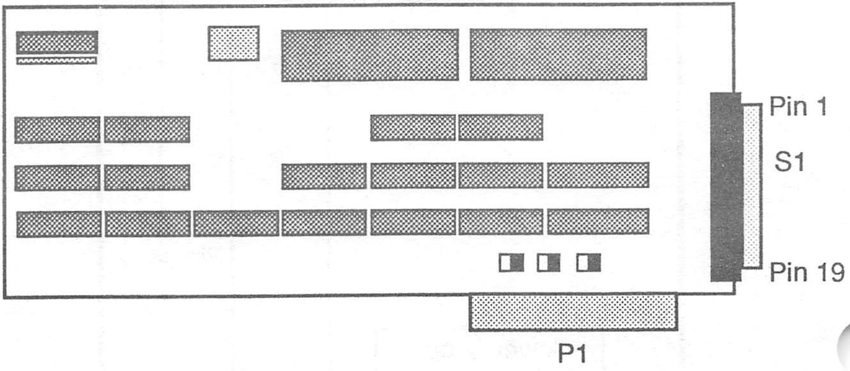


INSTALLATION FIGURE 5: 3 1/2" Diskette Drive Connections

Connect card S1 to drive P1

* ***IMPORTANT NOTE:*** The power connector on the 3 1/2" drive connects one way only! Properly hook up the power cable by making sure the red wire side of cable connection is connected as above.

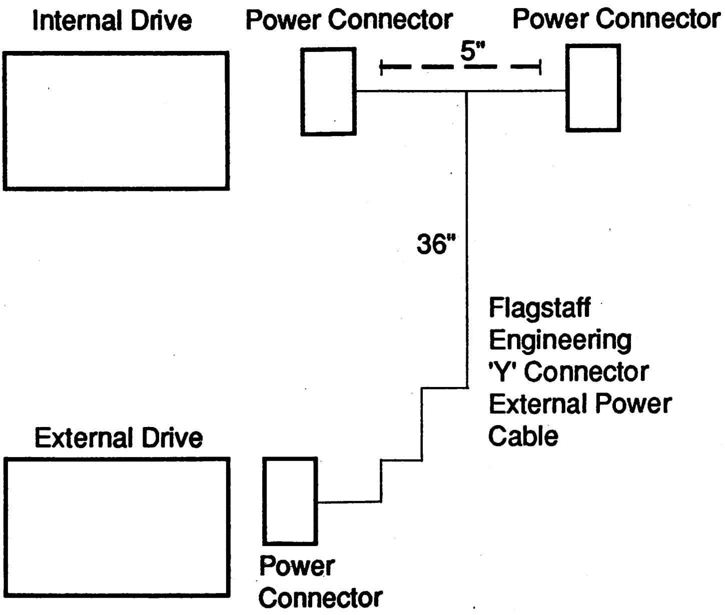
DISKETTE CONTROLLER CARD
General Layout



INSTALLATION FIGURE 6: Controller Card Connections

RED or BLUE stripes on cable edge
indicates "D" connector Pin 1.

GENERAL CONNECTION LAYOUT



INSTALLATION FIGURE 7: Diskette Drive Connections

DISKETTE CONTROLLER CARD DESCRIPTION

The diskette controller card included with your system is one of a series of types. Your card may have the hard or soft sector option installed depending upoin the system specifications given to FLAGSTAFF ENGINEERING at the time of purchase. As controller cards are updated, new versions will be released. You may check the upper left hand corner of your controller card to see which version card you have obtained.

The diskette controller card has an edge connector on the bottom of the card. The metal bracket is attached to the back edge of the card. The top of the bracket has a slot for a retaining screw used to anchor the card against the rear panel of your computer. In this manual, "Front" designates the end of the card without the retaining bracket.

A bank of jumper pins are located at the bottom of the card near the edge connector. Again, depending upon the version of the card, these connectors are layed out differently. The jumpers are labeled as INT, DAK and DRQ.

Cards will normally have straps on jumper pins marked 2. The card operates on DMA channel 2 when the jumper pins marked 2 are strapped. Likewise, cards operate on DMA channel 1 when the jumper pins marked 1 are strapped.

INT is the interrupt level request setting (IRQ) that the card operates on. Cards operate on IRQ 6 when the jumper pins marked 2 are strapped. Cards operate on IRQ 3 when the jumper pins marked 1 are strapped.

If the controller card is going to be used in a PC/XT/AT comptaible (ALL non-IBM machines), then the card should be optioned for DMA channel 1 use. See the Utility/8 software manual for examples to configure the software device driver for DMA channel 1 operation.

**** WARNING ****

Older IBM PC/AT Note

Older models of the PC/AT were supplied with long slot bus expansion connectors on the motherboard that do not have adequate separators built into the connectors. Your bus expansion connectors should have two molded-in black plastic separators that divide the connector into two sections. If you have an AT and the bus expansion connectors have only a thin piece of white plastic separating the sections of the expansion connector, you should take one of the following actions, since it is possible to misalign the controller card as much as one and a half full finger widths.

1. Have the motherboard replaced by an IBM service center since the bus expansion connectors are defective.
2. Seat the diskette controller board in one of the short slot connectors to insure proper aligment.
3. Seat the diskette controller board in one of the long slot connectors while making absolutely sure the board is as far to the rear of the connector as possible (NOT RECOMMENED).

If the controller card is misaligned, serious damage may occur to controller cards (including the Hard Disk Controller Card) and the motherboard in your AT!

HARDWARE INSTALLATION PROCEDURES

Installing Flagstaff Engineering's 8" diskette system on your IBM PC/XT/AT or comptaible is quite easy. The diskette controller card, supplied with the system, must be installed inside your computer in a vacant expansion slot. If you've previously installed IBM or other third party controller cards in your computer, the procedure will be quite familiar. If you have not installed a card inside your computer before, relax... you don't need to be an electrical or computer engineer to complete the installation.

The installation procedure is presented as a step-by-step series of instructions. Please don't hook up any part of the system until you've read through the installation instructions at least once. Becoming familiar with the parts of the system and the instructions will allow you to install the system correctly in a minimum amount of time.

To install your Diskette Connection system, perform the following steps:

1. Power down your computer. Set the power switch on the computer and any other units connected to your computer (expansion unit, external drives, etc.) to the OFF position.

2. Unplug ALL power cords from the computer unit, expansion unit, etc. WARNING--Failure to completely power off all components and unplug all power cords could result in serious electrical damage to your computer system.

3. Unhook from your computer system all attached periperhals (keyboard, monitor, etc.) and set well away from your working area.

4. Remove the plastic shipping wrapper from the diskette drive(s) unit. Open the door(s) on the diskette drive(s) and remove the cardboard insert(s) used to protect your drive's heads during shipping.

5. Remove the cover from your computer and set well aside. (See your system maintenance manual for removal.)

6. The controller card can now be installed in one of the system expansion slots located at the inside left rear of the computer unit.

7. To install the controller card, first remove the retaining screw from the expansion slot cover directly behind the system expansion slot you have selected to use.

8. Remove the expansion slot cover.

9. Hold the controller card by the top and firmly press the bottom edge connector of the card down into the expansion slot in the computer.

10. Place the retaining screw that you previously removed, through the retaining bracket at the back of the controller card and secure to the rear panel of the computer. The controller card is now installed.

11. Attach the connector of the ribbon cable supplied by Flagstaff Engineering to the edge connector at the rear of the controller card. The colored stripe that appears on the cable should be matched with Pin 1 of the edge connector.

12. DO NOT CHANGE ANY SWITCH SETTINGS INSIDE YOUR COMPUTER.

13. If you are using a 5 1/4" or 3 1/2" drive without a built in power supply, the power cable needs to be installed.

14.a On machines with one internal 5 1/4" drive, an unused cable and connector will be hooked to the machines power supply. Plug the end of the Flagstaff Engineering power cable with the 'Y' connector on it into the socket on the computer's unused power cable.

14.b On machines with two internal 5 1/4" drives, unplug the power cable from one of the internal drives. Plug the 'Y' connector end of the Flagstaff Engineering power cable into the socket into the power cable that was disconnected from the drive. Route the remaining end of the Flagstaff Engineering cable out the back of the computer. (See figure 7.)

15. Replace the cover on the computer and secure the cover to the unit with the cover mounting screws previously removed. (See your system maintenance manual for replacement.)

16. Reconnect all external drive cables.

17. Attach the connector of the ribbon cable supplied by Flagstaff Engineering to the edge connector located at the rear of the diskette drive unit. If your diskette drive unit has two drives, your interface cable will have two cable connectors. Attach a connector to each drive.

(The colored stripe that appears on the cable MUST be at pin 1 of the 8" drive's edge connector or pin 1 of a 5 1/4" drive's edge connector. See figures 3, 4, and 5.)

18. Plug any power cables from the computer, diskette drives, expansion units, etc. back into your electrical outlets.

19. Power on your computer system and external drives.

20. There should be no error messages displayed after your computer is powered up. If an error message is displayed, the most likely causes are improperly set switches inside the computer unit, cable(s) not reinstalled, or the controller card is not properly seated in the expansion socket.

If an error message occurs, power off the system and check for problems by going through the installation instructions once again to verify that all instruction steps have been properly completed. If the problem cannot be resolved, first consult the trouble shooting addendum at the end of this manual, or call Flagstaff Engineering's Technical/Customer Support department at (602)-779-3341 for further assistance.

TROUBLE SHOOTING ADDENDUM
EXTERNAL DISKETTE DRIVE SYSTEMS

This addendum is a guide to common problems and corrective actions that may be taken to resolve problems with Flagstaff Engineering external diskette drive systems. Problems that may occur with systems generally fall into one of the following three categories:

External diskette sub-system hardware problems
Environmental problems
Conversion problems

Two programs that are provided with Flagstaff Engineering systems to diagnose problems are CHECK8 and VERIFY8. These two programs help indicate specific system and environmental problems that may be manifested during the conversion process. These two programs are always to be run when a problem occurs to define the exact cause of the failure.

SUB-SYSTEM PROBLEMS

1. MACHINE WON'T BOOT

PROBLEM: Diskette controller card improperly seated in expansion slot.

REMEDY: Power off machine and reseat card.

PROBLEM: IBM floppy controller card has been replaced by external diskette controller card.

REMEDY: Restore original IBM card to system and put external diskette controller card in empty expansion slot.

2. 601 ERROR (Occurs during boot operation.)

PROBLEM: IBM floppy controller card has been replaced by external diskette controller card.

REMEDY: Restore original IBM card to system and put external diskette controller card in empty expansion slot.

PROBLEM: Machine was re-booted (warm boot) before FLAGIO.SYS device driver returned from a external diskette operation.

REMEDY: Cold boot machine to reset DMA channels and interrupt lines.

3. UNKNOWN ERROR MESSAGE (Diagnostic programs report UNKNOWN ERROR when executed.)

PROBLEM: Indicates controller card is misaligned in the expansion slot, or that the card is not making contact with all the connectors in the expansion slot.

REMEDY: POWER DOWN MACHINE IMMEDIATELY. Remove the controller card and reseat the card as described in section 4.0.

4. DRIVE NOT READY MESSAGE (Utility and diagnostic programs report DRIVE NOT READY when executed.)

PROBLEM: Diskette drive unit unplugged.

REMEDY: Make sure power cord for Diskette drive(s) is plugged in.

PROBLEM: Diskette drive unit powered off.

REMEDY: Make sure diskette drive power switch is on.

PROBLEM: Diskette drive not connected to controller card.

REMEDY: Reseat ribbon cable connectors on diskette controller card and diskette drive(s).

PROBLEM: Ribbon cable reversed going onto diskette drive (red light always on).

REMEDY: Remove ribbon cable from drive, turn connector 180 degrees and re-attach cable (red line on cable up on drive).

PROBLEM: Device driver not being loaded when the machine is booted.

REMEDY: Make sure a CONFIG.SYS file exists on the DOS volume that the machine is booted from. The CONFIG.SYS file must specify the correct device driver for the system. The device driver must be included on the same DOS volume as the CONFIG.SYS file, or pathed to in the config.sys file.

PROBLEM: Diskette in backwards.

REMEDY: Remove diskette from drive. Insert diskette into drive with diskette label facing to the left.

PROBLEM: Inoperative 5 Volt power supply in diskette drive

REMEDY: Call Flagstaff Engineering for information on possibility of returning diskette drive for repair and service.

5. 8" DRIVE LIGHT ALWAYS ON

PROBLEM: 50 conductor ribbon cable is reversed on edge connector at rear of drive.

ACTION: Power down computer and disk drive. Remove cable from the rear of drive. Untwist the cable and reconnect with red line on cable facing up.

ENVIRONMENTAL PROBLEMS

1. DMA OVERRUN MESSAGE (Utility and diagnostic programs report DMA OVERRUN when executed.)

PROBLEM: This usually occurs only when system is installed on PC Compatibles and clones. Generally due to unsupported IBM defined control signals on bus or BIOS incompatibility. This message indicates that a DMA transfer has failed.

REMEDY: Change CONFIG.SYS file and jumpers on card to indicate DMA channel 1, IRQ3 operation.

2. COMMON ERROR MESSAGES GENERATED BY MISSING OR INCORRECT CONFIG.SYS FILE

CONFIG.SYS		CARD JUMPERS		CHECK8	VERIFY8
DMA	IRQ	DMA	IRQ	RESULT	RESULT
NONE		2	6	BAD DISK COMMAND	BAD DISK COMMAND
NONE		1	3	MACHINE REBOOT	DISK SEEK FAILED
2	6	1	3	UNKNOWN ERROR	UNKNOWN ERROR
2	6	2	3	UNKNOWN ERROR	UNKNOWN ERROR
2	6	1	6	DMA OVERRUN	INVALID DISKETTE FORMAT
1	3	2	6	UNKNOWN ERROR	UNKNOWN ERROR
1	3	1	6	UNKNOWN ERROR	UNKNOWN ERROR
1	3	2	3	DMA OVERRUN	INVALID DISKETTE FORMAT

3. DRIVE NOT READY OR UNKNOWN ERROR ON ONE DRIVE OF TWO DRIVE SYSTEM WHEN PC/36 COMPUTER INTERFACED TO SYSTEM.

PROBLEM: PC/36 configuration controlling requests for first external drive (DOS diskette drive number three).

REMEDY: Change device select jumper on 8" drive to drive select number 2, or change PC/36 start-up files so that no virtual diskette drives are defined.

4. DRIVE NOT READY OR UNKNOWN ERROR ON EXTERNAL DRIVE NUMBER ONE WHEN USED ON SYSTEM WITH IBM SUPPLIED EXTERNAL 3 1/2" DRIVE. DRIVE MAY BE INTERFACED TO IBM 3 1/2" DISKETTE CONTROLLER CARD IN AN IBM PC/AT, OR THE BACK OF THE INTERNAL IBM DISKETTE CONTROLLER CARD IN AN IBM PC OR PC/XT.

PROBLEM: IBM device driver, DRIVER.SYS set up with parameters of d/:2. Flagstaff Engineering drive and IBM external drive look like same device to system.

REMEDY: Change device select jumper on 8" drive to drive select number 2. Add parameter to FLAGIO.SYS device driver statement in CONFIG.SYS file to read as follows:

```
DEVICE=FLAGIO.SYS (D=2,6,3E8) (T=2,6,350) E=2
```

The added parameter, E=2, will pass all requests for DOS drive 2 (the first external drive) to vector being controlled by DRIVER.SYS.

DRIVE SYSTEM WHEN PC/36 COMPUTER INTERFACED TO SYSTEM.

CONVERSION PROBLEMS

1. **SECTOR or TRACK NOT FOUND** (Utility and diagnostic programs report SECTOR or TRACK NOT FOUND when executed.)

NOTE* This message is normal in many programs during format identification. If the message is followed by "GOOD OPERATION", then everything is as it should be. If the message persists, the following problems may be occurring:

PROBLEM: Diagnostics being performed on hard sector diskette.

REMEDY: Use double sided, double density soft sectored diskettes for diagnostic checks on system.